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The Blundell Knapsack Injector.*

BY J. H. BUZACOTT.

THE Blundell knapsack injector was evolved as a result of extensive experimentation on the part of Mr. Ellis Blundell, of Daradgee, and has so revolutionised fumigation work that it has largely ousted other makes of hand injectors from popular favour. On account of the great reduction in labour costs effected by the new unit, it is probable that it will soon completely replace earlier types; therefore, drawings of the machine have been made, the parts listed, and a description made of its operation and troubles which may be experienced during use.

Description.

The Blundell injector consists of a brass knapsack supply tank connected by means of a rubber hose with an injector, which is composed of a tubular brass body fitted with a plunger pump of special design and provided with a hollow steel spear at the lower end. The principle of the pump is similar to that of the air pump on a "Primus" type stove or blowlamp; in fact, the lower bucket assembly consists of standard primus parts.

The operation of the injector proceeds as follows:—On pulling up the Tee handle (9, B and C), the fumigant from the supply tank gravitates down through the barrel of the injector and flows past the bottom plunger bucket assembly (22, B), which is a loose fit on the plunger rod to allow free passage for the liquid. On depressing the Tee handle, the bottom bucket assembly, which contains a valve seat, closes against the valve face on the lower end of the plunger rod (see detail E, Fig. 1). On further depressing the handle, fumigant is forced through the check valve mechanism (23, B) and thence through the hollow spear and out the exit hole near the spear point. Two wooden handles (14, B) are provided with the machine, but as a rule only one is used; in very hard ground some operators might prefer to use both, but this necessitates the withdrawal of one hand from the Tee handle and consequently slows down the rate of fumigation.

* Paper presented at the 1941 Pests Boards Conference; printed here at the request of delegates.

Adjusting the Dose.

When received from the factory, the injector is usually set to deliver a dose of approximately 4·5 ml. (about $\frac{1}{6}$ oz.), which appears to be satisfactory for most requirements, but if it becomes necessary to alter the amount of fumigant injected, a spanner is applied to the flats on the lock-nut (10, C) and the Tee handle (9, C) is then unscrewed. The lock-nut is adjusted up or down the back stop rod (12, C) until the right amount of liquid is discharged; movement upward gives an increased dose, whilst a downward travel of the nut reduces the dose. After adjustment, the Tee handle is screwed up tight against the lock-nut, which then becomes fixed so that a constant dose is discharged on each stroke of the pump. The length of stroke necessary to deliver a standard dose of 4·5 ml. is approximately an inch.

(NOTE.—A wrench should not be used on this or any other part of the injector. Fixed spanners may be used where necessary, but most parts should only be tightened by hand, and it is desirable to use a mixture of graphite and oil on all threaded portions to ensure their coming apart easily for replacement or repairs.)

Replacement of Buckets and Washers.

Either greenhide or ordinary leather may be used to rewasher the Blundell injector. The plunger rod top bucket and plunger rod bottom bucket are both ordinary primus washers and these should be selected so as to be of good quality firm leather. Some inferior types are on the market and should be avoided.

To replace the top bucket, the top cap (11, C) is unscrewed from barrel and the whole plunger rod assembly withdrawn. The plunger rod (20, C) may then be unscrewed from the back stop rod (12, C), the old washer removed and a new one placed in position, cup face downwards; the parts are then screwed together again. If the parts cannot be unscrewed by hand a spanner may be applied to the flats provided on the plunger rod for the purpose. The function of the top bucket is to prevent fumigant leaking out through the top of the injector. This avoids the use of a packing gland which was actually incorporated in earlier experimental models of the Blundell injector but proved unsatisfactory in practice.

The bottom plunger bucket is replaced by unscrewing the retaining nut (39, E) and removing the bucket assembly; the nut and valve seat of the assembly are screwed apart and the new washer fitted, also with the cup facing downwards. When fitting a new bottom plunger bucket, after clamping it between nut and valve seat in the correct way, it is a good plan to put the assembly on the plunger rod upside down, i.e., convex side downwards, introduce it into the pump tube in this way and work it up and down a few times. If then the rod be withdrawn and the plunger bucket assembly be replaced in the correct way, it will be found much easier to enter the bucket in the pump tube without destroying its shape.

The check valve seating washer (33, D) must be kept in good condition and is fitted by removing lock-nut (35, D) and check valve seat (34, D) and replacing the leather washer with another washer cut to the right size and inserted smooth side upwards. When replaced, the seat should be screwed up tight to the shoulder on the valve stem, as

the tension of the valve spring is not adjusted by the seat as in other injectors but by means to be described later. (For purposes of illustration the check valve seat is not shown screwed up to the shoulder of the stem in D, Fig. 1.)

The check valve body washer (30, D) is replaced if necessary by unscrewing the check valve assembly by means of the special tubular spanner supplied with each injector. This spanner is placed in the lower end of the barrel of the injector, after removal of the spear, and over the squared portion of the valve body (31, D). By turning to the left the valve assembly can be screwed out. The washer which makes the joint between the assembly and the barrel is the same size as the washers used for replacements in the ring and tail pieces (7, A) of the flexible hose and for the blank union (6, A).

The leather washer in the joint between the spear adaptor and the barrel should be kept in good order so that the adaptor may be screwed in hand tight and not leak. This joint is machined and a very little pressure in tightening will prevent leakage, provided there is no dirt in the joint and the washer is in good condition.

The large leather washer under the filler cap of the knapsack tank (2, A) should also be renewed if any sign of a leak occurs as it is an unpleasant sensation for the operator to have carbon disulphide spilling down his back.

All new or spare washers and buckets should be kept greased, or oiled with a leather preservative, so that they remain pliable; washers which have hardened should never be used. Losses of fumigant due to hard or faulty washers may be so small as to be barely obvious, but owing to the high cost of fumigating materials even small leaks can prove expensive in a season's work.

Adjustment of Check Valve.

The tension on the check valve spring (28, D) of the Blundell injector is not adjusted by turning the knurled seat (34, D). As stated previously, this cap should be kept screwed up tight to the shoulder of the valve stem. To adjust the tension, the stem is pulled down against the spring until the hole (32, D) is exposed. A wire of suitable thickness is passed through this hole and the shaft turned to the right to increase tension, or to the left to decrease tension. Too great a tension on the spring makes for difficult injection, whilst too little tension allows of leakage at the valve.

To remove the valve stem for cleaning purposes, the whole valve assembly is first unscrewed from the barrel as described above. With a wire through the hole in the stem in the same manner as is used for altering the tension, the stem is unscrewed to the left until it comes away from the nut (26, D). In performing this operation, care should be taken not to damage the valve face against which the leather washer bears.

(NOTE.—Increasing tension on valve spring may be accomplished by turning knurled valve seat to right, which operation helps to make a good seat on the leather washer. If, however, the valve seat be turned to the left to reduce tension on the spring the seat will tend to unscrew from the stem and this method of decreasing tension should therefore be avoided.)

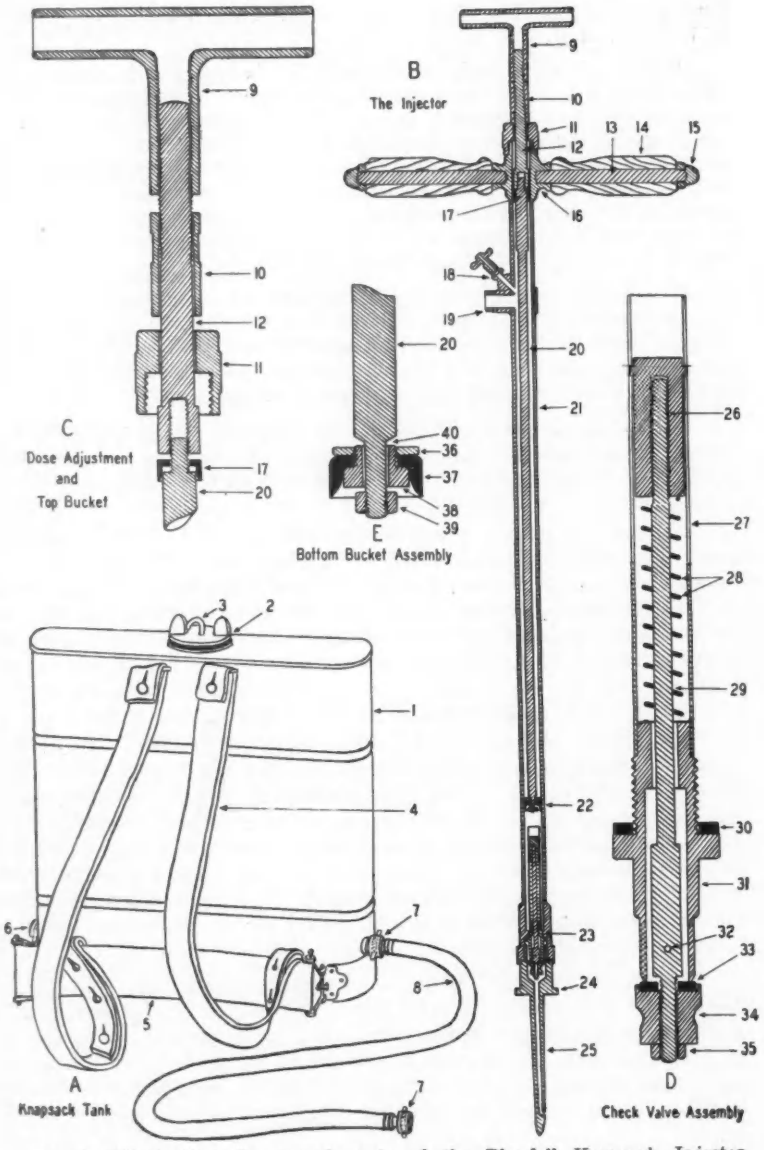

FIG. 1.—Illustrating the several parts of the Blundell Knapsack Injector (*see* Key opposite).

List of Parts of Blundell Injector.

The number on the left refers to the diagrams, the number on the right is the part number by which spares should be ordered. The serial letters B.F. must always be quoted when ordering parts, in order to avoid confusion with other Rega parts lists.

Ref. No. to Diagram.	Rega Catalogue Number.	
1	..	Main Tank
2	B.F. 35	Filler Cap
3	..	Vent Tube
	B.F. 36	Filler Cap Leather Washer
	B.F. 37	Strainer
4	B.F. 42	Leather Shoulder Strap
	B.F. 43	Strap Stud
	B.F. 44	Strap Hook
5	B.F. 39	Backrest Webbing
	B.F. 38	Backrest Complete
	B.F. 40	Backrest Bracket
	B.F. 41	Backrest Adjustable Bracket
6	..	Blind Hose Nut
	B.F. 45	Brass Blank for Blind Hose Nut
	B.F. 46	Leather Blank for Blind Hose Nut
7	B.F. 47	Hose Nut
	B.F. 48	Hose Tail
	B.F. 49	Hose Nut Leather Washer
	B.F. 50	Hose Clamp
8	B.F. 51	Hose—3′ 6″ of ½″ × 3-ply
	B.F. 52	Hose complete with ring and tail pieces
9	B.F. 1	Tee Handle
10	B.F. 2	Tee Handle Adjustable Locknut
11	B.F. 5	Top Cap
12	B.F. 3	Plunger Back Stop Rod
13	B.F. 13	Wood Handle Stud
14	B.F. 12	Wood Handle
15	B.F. 14	Wood Handle Locknut
16	..	Tee Piece Boss
17	B.F. 4	Top Plunger Bucket
18	B.F. 34	Air Release Valve
19	..	Inlet Stem
20	B.F. 6	Plunger Rod
21	B.F. 11	Pump Tube Assembly
22	..	Bottom Plunger Bucket Assembly
23	B.F. 15	Check Valve Assembly (Complete)
24	B.F. 32	Spear Adapter
	B.F. 33	Spear Adapter Leather Washer
25	B.F. 28	Spear 6″
	B.F. 29	Spear 5″
	B.F. 30	Spear 4½″
	B.F. 31	Spear 3″
	B.F. 24	Spear 6″ Complete with adapter
	B.F. 25	Spear 5″ complete with adapter
	B.F. 26	Spear 4½″ complete with adapter
	B.F. 27	Spear 3″ complete with adapter
26	B.F. 22	Check Valve Retaining Bush with Pin
27	..	Check Valve Tube
28	B.F. 21	Check Valve Spring
29	B.F. 20	Check Valve Stem with Stop Sleeve
30	B.F. 17	Check Valve Body Leather Washer
31	B.F. 16	Check Valve Body
32	..	Hole for adjusting Valve Spring Tension
33	B.F. 19	Check Valve Seating Washer
34	B.F. 18	Check Valve Seat
35	B.F. 10	Hex. Brass Nut 5/32″, 32 threads
36	B.F. 8	Bottom Plunger Bucket Hex. Back Nut
37	B.F. 9	Plunger Leather
38	B.F. 7	Bottom Plunger Bucket Valve Seat
39	B.F. 10	Hex. Brass Nut 5/32″, 32 threads
	B.F. 23	Check Valve Box Spanner.

Spear Point.

Spear points are made of steel with a knurled brass adapter near the end which screws into the pump tube. This adapter is large in diameter, it acts as a depth stop and it is also used for screwing the spear into the tube of the injector. It may be well to repeat here that this should only be screwed up hand tight and not tightened with a spanner; if the washer is in good condition leakage indicates dirt in the joint. When it is desired to remove the spear, if it be too tight to remove by hand, a fixed spanner may be applied to the hexagonal portion of the adapter. Spear points may be obtained of various lengths from 3 inches up to 7 inches and the depth of the dose is altered by substituting a point of the required length. However, a block of wood or a large rubber cork carrying a hole which fits the point tightly, may be used if necessary to reduce the depth at which the dose is discharged from long spear points.

Air Release.

In order to start the injector functioning when commencing to inject, or after refilling the tank, it is necessary to remove air from the pump tube of the injector. A quick release valve (18, B) is provided for this purpose and a half turn to the left will release the air, after which the valve must be screwed up tight with the fingers to prevent leakage of fumigant. The air release is also useful for removing gas locks which sometimes occur when fumigating during very hot weather; if not removed, these gas locks interfere with the operation of the injector.

On early models of the Blundell injector, the air release was not provided and to get rid of the air it was necessary to turn the injector upside down, remove the spear point and release the air by pulling up the check valve. Some operators using these early models are in the habit of undoing the top cap and removing the air by pulling up the plunger until the top bucket is free of the pump tube. This should not be done as the top bucket has been designed to work in a cushion of air. If operators persist in removing the air in this manner, the fumigant flows up round the top bucket, the lubricant is dissolved out from the leather and leaks consequently occur which necessitate frequent replacements of the buckets.

Tank and Hose.

The tank (A, Fig. 1) is provided with both left and right hand outlets and a blind hose nut is supplied with which to cover the outlet which is not in use.

An air vent is provided in the filler cap and a brass gauze strainer is placed inside the filling hole. However, this gauze deteriorates rapidly in use and, if it commences to disintegrate, pieces of gauze are liable to cause trouble in the injector. Accordingly, it is recommended to watch the strainer and replace when any signs of corrosion are seen. An adjustable canvas back rest and two adjustable leather shoulder straps complete the equipment of the tank.

The hose consists of about 3½ feet of half-inch fabricated rubber hose furnished with a ring and tail piece on each end. Ordinary garden hose proves quite satisfactory for replacements but kerosene or oil should not be passed through the hose when cleaning the injector.

Operation.

In operating the Blundell injector, a right handed operator usually has the hose coming in from the right hand side. It is customary to remove the wooden handle from the injector on the inlet side and retain the handle on the opposite side, although a few operators remove both handles and grasp the machine with the left hand round the barrel in the region of the T-piece boss. Ordinarily the injector is grasped by the remaining handle with the left hand on the Tee handle with the right hand. The spear is forced into the ground with the *left hand only*. The Tee handle is then pressed home to expel the dose and the injector withdrawn by pulling with both right and left hands. This method ensures the return of the plunger ready for the next stroke. It should be borne in mind that there is no spring return on the plunger of the Blundell injector, as is the case with the Dank's or Vermorel machines, and it is therefore necessary to pull back the plunger by hand ready to deliver the next dose. On this account it is desirable that the operator should adopt the above method so that his action becomes automatic and the pump will function correctly at all times. For a left handed operator the process is, of course, just the opposite to that outlined.

Care of Apparatus.

When in use the buckets of the apparatus should be lubricated several times a day. Glycerine is frequently used for this purpose although it is unsatisfactory under wet conditions. Various types of oil or Coacholine may be used and the ideal lubricant would be an oil or grease which is insoluble in either carbon disulphide or water. Castor oil has proved satisfactory in practice, although in common with practically all lubricants it is soluble in carbon disulphide.

The top cap has a small hole in it to prevent air cushioning on the up stroke of the plunger and by squirting oil down this hole the top bucket may be kept lubricated.

When the operator ceases work at lunch time and in the evening, all fumigant should be removed from the injector, and it should be flushed out with a mixture of kerosene and oil and the buckets well lubricated. Crank case oil may be used for flushing provided that it is free from grit. This kerosene and oil mixture should not be run through the flexible hose since it rots rubber and the hose and tank may be washed out each evening with soapy water containing a little washing soda. The shoulder straps of the tank should occasionally be treated with a leather dressing to keep them pliable.

The check valve assembly should be removed, taken apart and cleaned every day or so, since an accumulation of dirt and fluff lodges round the spring and will in time cause blockage or leakage of the valve.

When reassembling any screwed joints such as check valve assembly into pump tube, spear into pump tube, etc., a mixture of graphite and oil should be smeared on the threads. This means longer life for the parts and less delay when they have to be taken apart.

The spear point, being constructed of steel, should be smeared with oil or grease to prevent rusting when not in use.

Troubles Which May be Experienced.

The air vent tube in the filler cap of the tank has a rather small hole so that it tends to become blocked up with para-dichlorbenzene when the mixture is used. This sometimes results in the collapse of the walls of the tank. A collapsed tank may be restored to shape by means of air pressure but owners are recommended to replace the small air vent with a tube about three-sixteenths of an inch in diameter. In some instances, in very hot weather, the small vent does not allow of the escape of carbon disulphide vapour sufficiently quickly and pressure develops in the tank. The larger vent will also solve this trouble.

Should the plunger back stop rod (12, C) not move freely through the top cap (11, C) after cleaning, it is probably that the bumping of the back stop has slightly burred the hole in the barrel cap. This hole should be freed with a reamer or by the judicious use of a fine-tooth round file.

Operators have been known to insert extra washers and screw up the bottom plunger bucket assembly so that it is firmly attached to the tip of the plunger rod. This, of course, destroys the action of the pump which is designed so that the bottom bucket assembly has about three-sixteenths of an inch free movement on the plunger rod.

The air release valve sometimes becomes blocked with para-dichlorbenzene or fluff and should be cleaned by removing the valve and running a wire through the hole.

Sometimes in new pumps there is a slight burr on the inside of the pump tube, caused when the inlet hole is bored. Since this burr will rapidly destroy buckets, it is advisable to look through a new pump before putting it into operation to make sure that no rough edges protrude in the region of this hole.

Advantages Over Other Makes of Injector.

The Blundell injector possesses several advantages over other makes of injector at present on the market.

The hand piece of the injector is much lighter and can more readily be directed to where the operator requires.

Although it may take a while for the operator to become accustomed to carrying the weight of the fumigant on his back, it is generally conceded that it is easier to carry it that way than with the full weight on the arms.

An average operator can cover two thirds of an acre per day with the Blundell machine against one third of an acre with other models. This is most important since it reduces labour cost considerably and this cost constitutes a substantial proportion of the total cost of fumigation.

The Blundell tank holds sufficient fumigant to inject 24 chains of cane row on one side with the standard dose, whereas other makes on the market carry only enough to do seven chains. This means less time spent in refilling the Blundell tank, less fumigant spilt or lost through evaporation and obviates the necessity for having fumigant dumps in the middle of a field, as has been necessary previously, in order to avoid too much walking time.

Simplicity and rapidity of taking down for cleaning or rewashering, an improved check valve, a large filling hole in the tank which prevents waste of fumigant, and a smaller diameter spear point which renders

operation in hard soil much easier, constitute other minor advantages of the Blundell injector to which may also be added the larger exit hole in the spear point, making it less liable to blockage.

The main disadvantage of the Blundell unit is the weight of the fumigant-filled tank on the operator's back, but this drawback is considerably outweighed by the advantages of the machine.

Influence of Wind on Plant Growth.

It has been pointed out that in regions of strong winds, the growth of sugar cane in the outer rows is markedly affected by this adverse condition. Such a state of affairs existed at the Bundaberg Station before the southern boundary of the farm was protected by a giant privet hedge. This hedge has developed to such an extent that the depressed cane growth on the outer margin of the adjacent block has now disappeared.

Similar evidence of wind effects is demonstrated in a remarkable manner in the accompanying picture (Fig. 2).

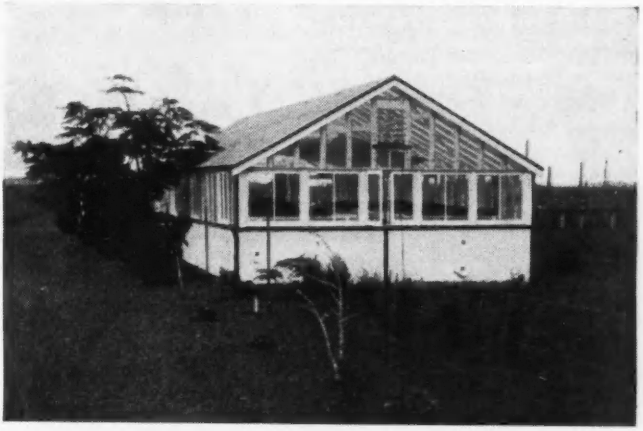

FIG. 2.—Illustrating the effect of wind protection on growth of poinciana trees: note stunted specimens in the foreground.

A row of poinciana trees was planted on the Mackay Sugar Experiment Station a few years ago. They were in an exposed position, and made very poor progress. About two years ago, the seedling hothouse was built, and the three trees which were given protection from the south-easterly wind by the structure immediately made normal development. The two remaining trees in the foreground (*see* Fig. 2) have retained their straggly, unthrifty appearance, and this is attributable to the strong wind effects to which they are exposed.

These facts should suggest to farmers the desirability of providing tree growth about the farm in such a way as to break strong winds. Not only does it provide useful shade for animals and enhance the appearance of the property, but it returns dividends in improved crop growth.

H.W.K.

Soil Erosion.*

BY H. W. KERR.

THE earth's fertile soil has been truly described as a capital asset which man, by his activity, can preserve, augment, or destroy; and the preservation of this fertility must be the foremost aim of every true agriculturist—it is the very foundation of any permanent agricultural structure.

The farmer who produces his crops under conditions of tropical temperatures and rainfall knows only too well the difficulties which attend any attempt to observe this dictum. These are conditions which promote the highest degree of activity of soil organisms, which quickly destroy crop residues and operate against the accumulation of soil humus. The ready release of plant foods in this way proves most beneficial to the growing crop, but the heavy rains of the wet season lead to the rapid removal of these foods by leaching, unless the crop roots are first able to absorb them.

These facts have been clearly appreciated by thinking farmers and soil scientists for a long time; but it is only of recent years that it has come to be realised generally that the fabulous fertility of tropical soils is a mere figment of the popular imagination; and that, though sometimes rich at first, they have not the ability to retain their riches which are very often dissipated at an astonishing rate.

So we understand why our cane growers of the wet tropics must devote so much attention to liming, to the purchase of artificial manures, and to those other practices which make for the conservation of a productive soil. They are merely waging war with the prodigality of nature, brought about when man upsets the delicate balance which exists between soil and vegetation on the virgin lands. But there is sometimes created in addition a set of conditions which leads to a tenfold acceleration of even this speedy process of fertility depletion. Not only is the plant food drained away by leaching, but the soil itself is removed as a body; and where this process has gone on to any pronounced degree, man is powerless to call a halt. As President Theodore Roosevelt once said: "When the soil goes, man goes, too."

The process known as soil erosion has been aptly described as the "tragedy of the death of soil fertility." Though it is only recently that many Australian farmers have become aware of the existence of this menace, it is not by any means an occurrence solely of modern times. The remains of old civilisations like those of Mesopotamia, Greece, and Northern Africa doubtless came as a result of the degradation of fertile soils which led to the formation of desert; and at the present time overstocking in Africa, due to so-called "modern" advances in knowledge, is creating its own problem in this continent, which is probably the most severe sufferer from erosion.

But perhaps the world's outstanding example of erosion damage is supplied by China. On the rich alluvial lands of that country cultivation has proceeded unimpaired by erosion. This has been possible due to the care of the farmers to return organic refuse, and in other ways

* Address delivered at Meringa Sugar Experiment Station, at the joint Field Day and Sugar Technologists' Agricultural Session, 19th April, 1941.

minister to the needs of the land. On the slopes, however, wide areas of loessial soil have been completely denuded and ruined by washing, over many centuries. Attempts to stem the losses, by terracing, have merely slowed down the process, and erosion still goes on.

Position in U.S.A.

In the United States of America the destruction of fertile lands by wind and water erosion provides what is probably the major problem which that country now faces; and all this has been brought about in a mere century or so, by ill-guided agricultural systems which did not observe the necessity for soil preservation. Originally, only some 2½ per cent. of the land area was classed as desert, but in the course of two or three generations nearly one-half of the forests have been cleared, and a large part of the prairies, from the Rockies east, has been brought under the plough. Retribution has been astonishingly swift. Recent surveys showed that 10 per cent. of the total land area of the United States has lost more than three-quarters of its topsoil, 30 per cent. has been moderately eroded, and 4 per cent. has had most of its topsoil blown away by dust storms.

Coming nearer home, we find that over-grazing in South Australia has destroyed the vegetation and wind erosion has commenced its work. In New South Wales, Victoria, and even on our own Darling Downs water erosion is leaving its mark, and Governments are grappling with this preventable problem. For man must realise that he cannot be a parasite on the land; he must enter into partnership with the soil—giving as well as receiving; and the results of efforts to control this menace will determine the future of soil fertility.

Causes.

A careful study of causes may reveal the steps to be taken to prevent the trouble, for it is everywhere recognised that this is definitely a trouble where prevention is both simpler as well as more effective than cure. As water erosion alone concerns us in the sugar districts, attention will be confined to this phase of the problem.

It is a significant fact that erosion effects are generally much more prevalent in regions of moderate rainfall than they are in districts of very heavy precipitation. But one point must be clearly appreciated—erosion does not occur under conditions of natural jungle or forest cover. To make this statement is but to emphasise a truism; for otherwise the soil we find there could not have become established and developed to a state of maturity. Certainly geological processes lead to the gradual removal of, chiefly, exhausted material which has made its contribution to the fertility of the soil; but this takes place only at a speed equal to that of the process of soil formation. Sometimes the depth of soil extends to many feet, while at others it may only be a few inches. But this equilibrium is easily disturbed by man. Removal of the vegetative cover, unless this be done with due regard to all the consequences, and the influence of subsequent cultivation processes may so accelerate the denudation of the land that the result is disastrous. The amount of soil which takes a century to grow and accumulate may be swept away in a year—or even by a single storm. The problem involves, of course, the question of soil fertility in its broadest sense. It is not merely one of plant food supply, but the question of soil stability is intimately involved. When the soil becomes exhausted it becomes unstable, and is then moved bodily.

Vegetation's Aid.

We recognise then that the vegetation plays an all-important part in the preservation of the land. It protects the soil from the erosive effects of wind and rain. The loss of fertility and humus brought about by cropping or cultivation may possibly be made good by the use of fertilizers and the preservation of plant residues; but even these must fail if the agricultural system does not produce equivalent physical effects on the soil as did the natural vegetation. The deterioration of these factors provides the prelude for actual erosion. Very frequently a change of climate is blamed for a falling off in crops; but it is the land which has changed. The unstable soil is first removed by sheet erosion, and because this is not readily perceptible it often passes unrecognised. Later, small gullies become evident, and these rapidly grow until the land surface is heavily scarred and defaced. When this stage has been reached only drastic remedial steps possess any chance of success.

FIG. 3.—Showing how advancing soil, blown by the wind, is wiping out farms and buildings in U.S.A.

Extensive and intensive studies of erosion causes have been made in the United States, and are proceeding. It has been found that the cultivation of land with greater than 8 per cent. slope gives such heavy losses of topsoil that it should be kept under permanent grass. In other words, it is virtually impossible to preserve such land if it be cultivated at all. An interesting study carried out in Oklahoma showed that whereas land under grass lost soil annually at the rate of only 0·04 tons per acre, a similar field planted to cotton lost 39 tons per acre. These facts have been repeatedly demonstrated.

Of interest to cane growers should be the finding that continuous one-crop cultivation on slopes has been one of the most serious factors contributing to erosion losses. Cotton and maize are the chief offenders in that country. In Iowa it was found that even slight slopes in corn areas were losing topsoil at the rate of 60 tons per acre. Doubtless parallel conditions could be found in parts of the Queensland sugar

cane belt. Very often the moderate hillside slopes which are cultivated in areas, such as Innisfail and Childers, carry a deep red volcanic soil; and because of the almost imperceptible change in colour and texture from topsoil to subsoil, the loss of even a foot or more of the valuable surface layer may pass unnoticed. But evidence is readily to be found in the depleted productive capacity of the land, and oft-times in the fences or walls at the bottom of the slopes against which is piled much of the eroded fertile soil from the hilltop.

FIG. 4.—Showing how gully erosion develops from sheet erosion.

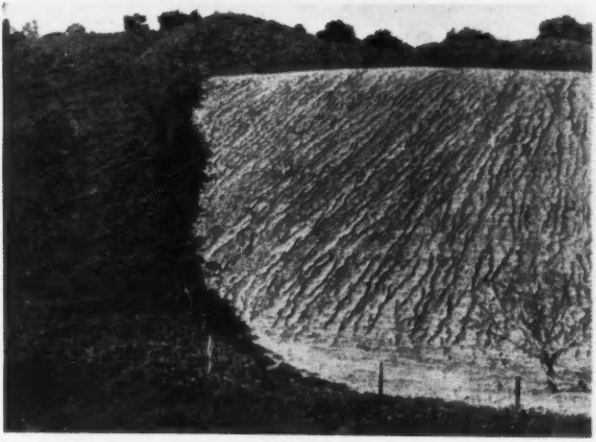

FIG. 5.—Showing the influence of vegetative cover: the bare land (*right*) lost 500 tons of topsoil per acre, from a single storm: the protected land (*left*) practically none.

Prevention.

As with all diseases, the prevention of soil erosion is better than the cure; and it should be the duty of every farmer cultivating sloping lands to appreciate the several factors which contribute to the causes of erosion and to adopt those measures which will avoid its occurrence.

It is a happy circumstance that most of our best cane lands are alluvial in character and are thus not seriously subjected to this menace. However, where hillside slopes are cultivated for cane, the trouble is likely to be severely exaggerated. Firstly, the cane grower is usually a one-crop farmer; secondly, he is required to confine crop production to that area which is assigned for the purpose, and the regulations under which he operates enable him to harvest virtually 75 per cent. of this area annually. Finally, cane assignments have naturally been granted without any thought of the dangers of erosion damage. Such a combination of circumstances may therefore be very harmful. We have already indicated the menace of one-crop farming, and the period of rest which such land normally enjoys is a mere three to six months in, say, four years. This provides barely time for the growing of a leguminous cover crop, which, though definitely of great value, can scarcely be regarded as constituting a rotation system.

FIG. 6.—Showing extensive gully erosion in a Babinda cane field.

Communal Problem.

There is abundant evidence to demonstrate that the erosion problem is not simply an individual matter; it is essentially communal in character, and obviously requires the attention and close supervision of a governing authority, whose duty it is both to educate the community in the accomplishment of its aims and in laying down the principles which must be rigorously enforced if necessity arises.

It is not possible, in the scope of this brief address, to do anything more than formulate the major guiding principles which have been established. The problem, as we have seen, is to prevent, retard, or regulate the removal of run-off water from the land surface, so that disturbance of the soil will not occur. To promote the maximum absorption of rain water, the soil should be maintained in a condition similar to that of the virgin land. Most cane growers should vividly appreciate

what this involves; it requires the maximum effort in conserving or building up humus, which is probably the most important single factor contributing to the retention at all times of an absorptive soil. Cultivation methods should be adopted with care, and intelligence applied in their performance. Though cultivation is good for the crop we have stressed repeatedly that it is bad for the soil; and though it is employed to offset the forces which tend to consolidate the land and destroy its tilth it in itself is a prime factor in breaking down the desirable "crumb" structure of the soil, and in the production of hard pans which seriously obstruct the ready uptake and percolation of water in the soil. It has been demonstrated under a range of conditions that erosion losses have been maintained at their lowest level where hillsides can be cropped without recourse to work with implements. Deep grubbing is the most desirable operation on hillsides, if cultivation must be done, as it can be employed to open up the soil to the greatest depth while breaking down the ill-effects of surface tillage implements.

FIG. 7.—Illustrating the commencement of a headland gully on a Tully farm.

In spite of everything that might be done to promote the most complete absorption of rainfall, there will always occur deluges which would seriously overtax the absorptive power of even a deep sandy loam. The complete prevention of run-off is thus impossible. Provision must therefore be made to take away the water in such a manner that the soil is not damaged in the process.

One relatively simple expedient for holding moderate amounts of run-off water is the use of contour furrows, the soil from which provides low ridges extending across the slope at suitable intervals. These trap the run-off water from above and hold it until it can be absorbed. This system is found most useful with non-cultivated crops such as grass, but it fails in its purpose, and may even aggravate the damage if the furrow becomes speedily filled and overflows; the position may be disastrous if this should happen before the ridge becomes consolidated and protected.

Make Terraces.

The most successful plan under such conditions is the construction of terraces. Briefly, this consists in converting the slope into a succession of wide, practically level benches, with a short, though steeper drop from one terrace to the next below. More complete details of terrace construction will be found in the chapter of the "Cane Growers' Handbook" devoted to this subject. This plan assures the maximum opportunity for the absorption of the rainfall on the flat surface, while the slope, though steep, is so short that the water flowing down it does not attain such a speed as to cause the removal of much soil to the terrace below.

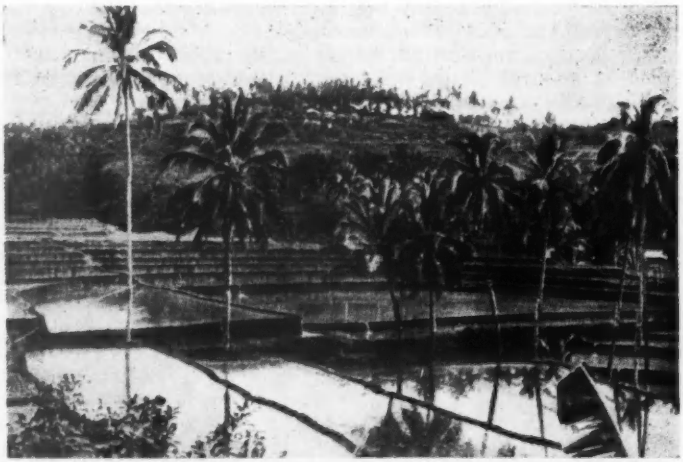

FIG. 8.—Showing the terracing for rice culture which is a feature of hillsides in the East Indian islands.

Precautions, of course, must be taken to provide for the removal of excessive water and its conduction to natural drainage courses at the lower levels. The terraces are therefore given a slight slope, usually from the centre to both sides, of the order of 6 inches per 100 feet. Further, the terrace usually has a slight slope backwards from its outer edge, to avoid the stream cascading down the slope. Finally, the terrace should terminate in a well-defined gully, which serves to take care of inevitable run-off; these gullies are protected against erosion by grassing, by the installation of stone, wooden, or even earthen dams, or by the use of any other obstruction which will check the velocity of the water.

We have no knowledge of the adoption of the terrace system in the sugar areas of Queensland; but farmers on gentle slopes are urged to give this plan their serious consideration. When properly constructed, terraces offer no problem to the use of cultural implements, as the usual methods can be carried out without any heed to their existence.

One or two points are most important in attempting any earth sculptural methods such as those just discussed. Firstly, earth ridges or terraces are most vulnerable just after they have been built, when the soil is loose and incoherent. They should therefore be constructed at such times as heavy downpours are most improbable. They thus have

a chance of becoming firmed and bound together before they are tested by flood rains of the wet season. Secondly, the job should always be commenced at the top of the slope and never at the bottom. Many farmers choose to spread the work over successive seasons, so that only a proportion of the terraces or furrows is liable to washing at any one time, in the critical period which precedes consolidation of the soil.

FIG. 9.—Contour banks such as these are effective in controlling slight slopes.

FIG. 10.—Showing the simplest method of combating sheet erosion: strip-cropping with alternate strips of different crops.

Cane Growers' Advantage.

There is one important respect in which the cane grower possesses a distinct advantage over other farmers cultivating slopes. He has not to plough out each year, after the crop is harvested, while the trash and tops are available to assist in erosion control. The value of the latter factor is not at all well appreciated under these conditions. Its conservation provides a mulch which controls weeds and eliminates excessive

cultivation. When compacted by rain it offers strong resistance to removal by running water; it thus checks the velocity of flow in much the same way as the leaf mould, roots, &c., did on the virgin land; while the water which is shed flows rather from the trash than from the soil, and the latter is thus protected. Finally, it leads to increased soil fertility, and an improved physical condition in the land, which make for successful ratooning, and the less frequently such areas require to be disturbed by ploughing, the better for the soil and its safety. Many northern growers object to this policy, because they claim it leads to increased borer damage to the crop; but our entomologists have made it clear that this occurs chiefly when a few well-recognised precautions have not been taken. It is admitted, however, that for hillside conditions, a hardier cane variety with a strong rooting system and ratooning capacity is definitely needed. This is a responsibility which our plant-breeder will not overlook.

FIG. 11.—Illustrating the use of a leguminous vine (Kudzu) in protecting gullies against further erosion.

I might also make reference at this time to the plan of "strip" or "contour farming" which many farmers have adopted overseas as a means of minimising erosion damage. When it was recognised that the cultivated crop is the worst offender, a plan was devised for laying out the farm in narrow strips running at right angles to the slope, with alternating cultivated and non-cultivated crops in the successive strips. Any tendency to excessive erosion is thus checked when the running water encounters the area of grass or other non-cultivated crop; its velocity falls, and the load of sediment which it may carry is largely deposited once more. Though this does not eliminate erosion, it certainly guards against serious loss of soil from the farm.

This scheme may have limited application in the cane areas; but it should not be overlooked and may prove very useful in those places where standover cane is grown. A strip of cane which is to stand until the following year will provide useful assistance in preventing serious erosion losses from the immediately adjacent cultivated fields above and

below it. In more serious circumstances it might be well worth while interposing narrow fields of some permanent grassland between canefields, and after a period of years changing over from cane to grass and from grass to cane.

Perhaps further points of interest will be brought out in our subsequent discussion; but I would like, in closing, to stress that the land of this great continent is merely held in trust by the individual, for future generations; the robber agriculturist must therefore be eliminated and soil exploitation prevented.

Mr. Bulcock's Address.

In opening the discussion, Mr. Bulcock delivered an interesting address on his overseas experiences in connection with soil erosion. He stressed the severe and lasting effects of soil erosion on the land and said that in Australia we are not as yet face to face with this problem in its most serious form. The effects have been most apparent in countries which have been practising agriculture for many years. Serious erosion in South Africa was chiefly the result of overstocking. In the United States of America most interesting phases of erosion were apparent. Control methods employed there were much more comprehensive than in any other country and involved as a first angle of approach the prevention of further erosion. This involved contour furrowing and terracing. He had been assured that terracing had had a beneficial effect quite apart from the erosion control aspect, resulting in a 47 per cent. increase in productivity in one case which he quoted. Mr. Bulcock described the method of treatment for gullies by the provision of a dam at the lowest point, thus causing a deposition of soil; this practice had given remarkable achievements in restoring land to its previous levels.

It was suggested by Mr. Bulcock that prevention measures be taken here where it was considered desirable. He believed a soil erosion consciousness would be created in this State, and he felt sure that the co-operation of those vitally concerned would be readily forthcoming. He considered that vegetation constituted the most efficient method of protection. He stressed that attention should be devoted to the preservation of trees, the provision of belts of trees, the preservation of grass lands and the vegetation of creek beds, and the desirability of a shallow finish at the end of the ploughing of the field. He thanked the chairman for the opportunity of addressing the gathering on this subject.

Seventh Conference of Cane Pests Boards.

BY ARTHUR F. BELL.

THE seventh conference of Cane Pests Boards was held in the Ingham Shire Hall on Thursday, 1st May, and, in many respects, proved to be the most interesting and informative conference yet held.

Mr. A. B. Farquhar, Chairman of the Victoria Cane Pests Board and Manager of Victoria Mill, was elected Chairman for the day and presided over a very representative delegation from fourteen Pests Boards and the Bureau, viz.,

Mossman: N. H. Wellard and A. R. Taylor;
Mulgrave: W. C. Griffin and P. Volp;
Goondi: K. W. Maclean;
South Johnstone: G. Wilson;
Mourilyan: V. Seres and E. H. Fox;
Tully: S. B. Best and E. C. Powell;
Macknade: H. Smith, K. R. Gard, and F. J. Waring;
Victoria: A. B. Farquhar, W. C. Fraser, K. Livingston, E. L. Burke and E. D. Row;
Invicta (Ingham Line): H. F. Hecht, E. R. Marshall, G. Peebles and R. Clarence;
Invicta (Giru): W. E. G. Smith and G. Stockham;
Kalamia: P. Sayers and F. W. Reading;
Inkerman: H. V. Hanson and H. A. Barton;
Mackay: F. H. Stevens and W. R. Vacher;
Plane Creek: J. C. Nicholson and S. T. Dent;
Bureau of Sugar Experiment Stations: A. F. Bell, R. W. Mungomery, W. A. McDougall, J. H. Buzacott and H. G. Knust.

Apologies were received from Messrs. C. L. Richardson (Hambledon), R. H. Watson and W. J. Ryan (Babinda) and J. C. Collier (Mackay) who were prevented from attending by unforeseen developments.

Discussions of the conference centred around some seven papers (summarised below), which had been prepared for consideration, as well as resolutions from individual Boards. Discussion was at all times keen and sustained and proceeded until 5.45 p.m. Delegates were entertained by the local Pests Boards and on the following morning were conducted on a tour of the district, and a visit to the Macknade Mill, through the courtesy of the C.S.R. Company.

"Storage of Carbon Disulphide," by G. Wilson.

This paper comprised a very complete and thoughtful dissertation on the problems associated with storage of carbon disulphide and it was discussed at length by delegates. Both papers and discussion are of particular interest to Pests Boards and should be carefully read by all Board members, particularly at this juncture when storage of reserve stocks is imperative.

"Factors Affecting the Distribution of Cane Grubs," by J. H. Buzacott.

Even in the absence of any control measures, including tree felling, the numbers of beetles and grubs fluctuate markedly from year to year. A year of heavy grub damage may be followed by a year of very light infestations, or a heavy beetle flight may be followed by extremely light grub infestation. Mr. Buzacott sets out evidence to show that the most important natural factor in depleting numbers of grubs is the occurrence of dry hot soil conditions immediately following laying of eggs by the beetles in December and/or early January.

Part of the discussion on this paper dealt with the varying attraction of different varieties of cane for beetles and it was generally conceded that cane with the thickest cover is the most attractive. Several delegates reported that the quick striking, quick covering, seedling Q.10 attracted

beetles from other varieties and it was suggested that the area to be fumigated might be decreased by planting strips of Q.10 through fields of poorer covering varieties and concentrating fumigation in such strips.

"**Dilution of Carbon Disulphide,**" by J. H. Buzacott.

Mr. Buzacott outlined a series of experiments in which a number of other volatile substances had been mixed with carbon disulphide in the hope of obtaining an equally effective but cheaper fumigant. However, the results gave no indication of success in this direction.

"**The Blundell Knapsack Injector,**" by J. H. Buzacott.

This paper includes a detailed description of the Blundell injector, its operation and servicing, and difficulties likely to be encountered. At the express wish of conference this paper is reproduced in full on page 1 of this issue.

Delegates made numerous suggestions for minor improvements to the injector and no doubt some of these will be tried out by Pests Boards during the coming season.

"**Frenchi Grub Attacks,**" by R. W. Mungomery.

Damage due to Frenchi grubs has been on a somewhat increased scale in the far north during the past few years. This grub has a two-year cycle, but it is only active in the upper layers of the soil at certain times. It is during such a period that the grub must be attacked by ploughing; when land is normally ploughed for autumn or spring planting the grub has retreated to lower layers in the soil and is unharmed by the implements; the best method of control therefore involves fallowing and good deep ploughing during late spring or early summer.

This paper is of special interest to northern growers and will be published in the October issue of the Quarterly Bulletin.

"**The Stomach Contents of Giant Toads,**" by C. L. Richardson.

Mr. Richardson dissected and examined the stomach contents of 107 toads collected in the Hambledon area. This examination showed that, while few greyback beetles had been devoured by the toads, the number of Frenchi beetles accounted for encourages the belief that this predator is performing useful work in the control of this latter pest.

Other speakers expressed the opinion that the toad was proving beneficial in controlling the beetle borer of cane, and garden pests generally. Reference was also made to the decrease in snakes and death adders due to the fact that the swallowing of a toad usually means death to these reptiles.

"**Red Squills,**" by W. A. McDougall.

Due to threatened shortage of other rat poisons, Mr. McDougall last year undertook the investigation of Red Squills as a possible substitute. His researches show that the toxicity of Red Squills is far too unreliable for use in canefields and we must still rely on thallium and phosphorus.

Delegates voiced concern at the increasingly late deliveries of carbon disulphide each season, due to shortage of shipping and also to the restrictions on shipment of this commodity imposed by the navigation authorities. One Board reported having an order already eight months overdue. As this fumigant is manufactured in Melbourne there is no shortage of the product itself, the difficulty being solely that of transport. Arising from the discussion several resolutions were passed requesting the appropriate authorities to take certain steps to facilitate transport of carbon disulphide.

The importance of bird life in the control of insect pests is firmly established and recognised everywhere. Several members of the conference reported that there had been a marked increase in the bird life in their particular areas following the wholesale confiscation of firearms last year. It was felt that the welfare of the sugar industry must be regarded as pre-eminent in cane areas and a resolution was adopted asking the State Government to consider the permanent restriction of indiscriminate use of firearms in bird sanctuaries in cane areas.

The question of supervision over the expenditure of funds by compulsory Cane Pests Boards was discussed at some length, some delegates contending that Boards should be permitted to have full authority to spend their funds in any way they thought fit. Eventually it was resolved to ask the Advisory Board of the Bureau of Sugar Experiment Stations to recommend that where a majority of growers in any area decided in favour of any certain method of pest control, that permission be granted to utilise funds in carrying out that form of control.

It was decided that the 1942 Conference should be held in Tully.

Full minutes of the conference are being transmitted to delegates and members of Pests Boards and these may no doubt be consulted should any grower be interested in any particular phase of the discussions.

Spread of Gumming Disease from Trucks of Diseased Cane.

Farmers in the Mulgrave and Hambledon districts are warned that there exists a very considerable risk of infection of their farms with gumming disease when their fields abut on tramlines.

Badly diseased cane exudes "gum" from the cut ends of the stalks, and should the stalks brush against the leaves of standing cane, some of the gum will be smeared on the leaves. In wet weather, or when the leaves are wet with dew, the bacteria contained in the gum will be enabled to swim into wounds in the leaves and so set up infection which will rapidly spread through the field.

Cane which is being hauled to the mill from an infected farm should on no account be allowed to come in contact with cane on healthy farms en route, and farmers are advised to clear either side of the line sufficiently to prevent this occurring.

A.F.B.

New Seedlings for Field Trial at Mackay.

Yield trials conducted in the Mackay district during the past two seasons have produced two varieties of some promise, namely, Q.28 and Comus. It is proposed to test these two varieties more extensively during the coming season, while propagation plots will be established in each mill area in order to provide plants for 1942 should their earlier promise be maintained.

Q.28 is a Mackay-raised seedling germinated from the cross Co.290 × Q.1098. Co.290 is well known as a vigorous growing cane in the Mackay district, while Q.1098 is one of the old seedlings raised years ago by the Queensland Acclimatisation Society. The variety has so far proved a quick and sure striker, a fact which may assist greatly in resisting the attack of the Frenchi grub pest (*see* "Quarterly Bulletin" for April, 1941, page 142). Foliage is erect, so that cover is somewhat light, necessitating more attention to weed control than is required with Co.290. Stalks are erect and reasonably free trashing; arrowing is free. So far as our present knowledge goes the sugar content cannot be classed as high but should be very materially better than Co.290. Resistance to downy mildew has so far been good and it is hoped that this variety will prove to be the much-sought substitute for Co.290.

FIG. 12.—Showing the rapid early growth of Comus (*right*) as compared with 1900 Seedling (*left*).

Comus was propagated on the Northern Rivers of N.S.W. by the Colonial Sugar Refining Company and is a seedling from the cross Oramboo × Q.813. It is very rapid and sure striker, getting away to a quick start (*see* Fig. 12). As in the case of Q.28 this attribute enables it to withstand damage by Frenchi grubs to a marked degree. Comus is a stout soft cane of high sugar content and is a very attractive cane from the harvesting point of view. It does not arrow freely and has shown high resistance to downy mildew. Its chief drawback is its high susceptibility to mosaic disease and it cannot be expected that it can be grown successfully for any length of time on river flat country or in the foothills where mosaic disease is likely to be a factor.

A.F.B.

A Domestic Solar Water-heating System.*

BY G. BATES.

Design and Construction.

THE idea of utilizing the radiant energy of the sun as a means of heating water is by no means new, but it appears never to have been developed in Australia, in spite of eminently suitable conditions. An article written by Dr. H. W. Kerr, and published in the "Cane Growers' Quarterly Bulletin" for April, 1936, inspired the writer to construct a domestic unit with the object of testing it under North Queensland conditions. The results have been gratifying, and the following particulars regarding the construction and lay-out of the system are furnished in the hope that others will be encouraged to adopt this simple and cheap method of heating supplies of water for domestic and other purposes. It is appreciated that there are a number of points where experience has shown that this particular installation could be improved, but on the whole it is quite efficient and supplies all the hot water needed for the home.

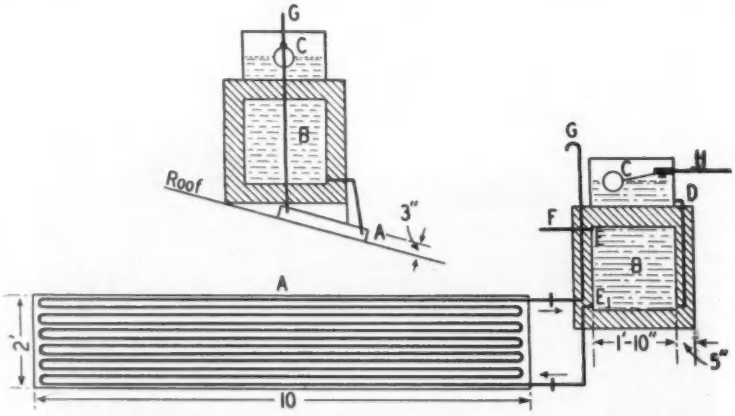

FIG. 13.—Illustrating the design of the solar water-heating system:—
A.—Absorption chamber.
B.—Storage tank.
C.—Supply tank with ball valve.
D.—Connection from supply tank to storage tank, ¾ in.
E, E_1.—Connections from storage tank to heating coil, ¾ in.
F.—Connection to domestic supply pipe, ½ in.
G.—Vent pipe, ½ in.
H.—Connection to main water supply, ½ in.

The unit consists of two distinct parts, the *absorber* and the *storage tank*. The working of the system depends upon the ability of a black surface to absorb heat when exposed to the sun, and the fact that convection currents can be used to bring about continuous circulation of heated liquids. The absorber is composed of a bank of pipes or "flat" coil of

* Paper presented at the Cairns Conference of the Q.S.S.C.T., 1941. Adapted by permission of the Society.

¾-inch iron water piping, set on a sheet of galvanised iron within a shallow box, and protected from the cooling action of wind by a glass cover. The coil contains twelve lengths of piping each 9 feet 3 inches long, joined together by low pressure return bends (*see* Fig. 13). This length of pipe was selected mainly because it was obtained by cutting standard lengths of water-piping in halves, thus reducing the labour required to make the coil. To increase heat absorption, the coil and galvanised iron were painted black after setting in the shallow box. The dimensions of the box in this installation are 10 feet by 2 feet, giving a heat absorbing surface of 20 square feet. The upper part of the coil is connected directly to an insulated storage tank, while a feed pipe leads from the base of the storage tank to the lower portion of the coil; the base of the absorber is set somewhat lower than the bottom of the storage tank. The storage tank is made from plain galvanised iron and is insulated by a layer of sawdust of 5 inches minimum thickness; the use of a copper tank would be a distinct improvement.

The maximum amount of heat is absorbed when the rays of the sun strike the absorber at an angle of 90 degrees, but, of course, this angle could not be maintained throughout the whole day unless the absorber were mounted on gimbals and mechanically rotated. In practice, it is found sufficient to expose the absorber on a northerly slope of the house roof at an angle of some 15 degrees from the horizontal.

The operation of the system can best be explained by reference to the diagram (Fig. 13). On exposure to the sun, water in the coil A becomes heated and rises by convection and flows slowly upwards, eventually entering the storage tank at its highest point, E. The warm water thus removed from the coil is continuously replaced by cooler water from the base of the tank through the outlet (E_1). There is thus a continuous circulation of water while the sun is shining, the temperature of the water in the storage tank gradually increasing throughout the period of sunlight. The household requirements are drawn from the topmost layer of water in the tank (this being the hottest zone) through the ½-inch pipe, F. The supply in the tank is then replenished from the base through the intake pipe, D, this flow being controlled by a ball valve operating in an overhead 6-gallon supply tank, C, connected with the service supply pipe, H. In order to minimise losses by radiation and maintain supplies of hot water overnight, good insulation of the storage tank is an obvious essential.

It has been determined in the United States of America that a minimum average of six hours' sunlight per day is necessary for the successful operation of a solar heater: under such conditions, 1 square foot of heating surface (i.e., the coil and the metal to which it is clamped) will heat 1 gallon of water per day to approximately 150 degrees F., the temperature rising with increasing hours of sunlight. The storage tank should be of ample capacity, and in a domestic installation it is a good rule to allow a daily average of about 15 gallons per member of the household, although this quantity can be reduced in warmer climates.

In the installation under consideration the capacity of the storage tank is slightly less than 40 gallons, while the area of the absorber is only 20 square feet, or half the generally recommended ratio. Against this, however, is the fact that the intake temperature of the water is comparatively high.

The cost of this installation, purchasing materials at retail rates in Cairns, and having the storage and supply tanks made by a local plumber, amounted to a little more than £10. The assembly and general construction were carried out by the writer and a friend, and, once the design was worked out, the time required was not great.

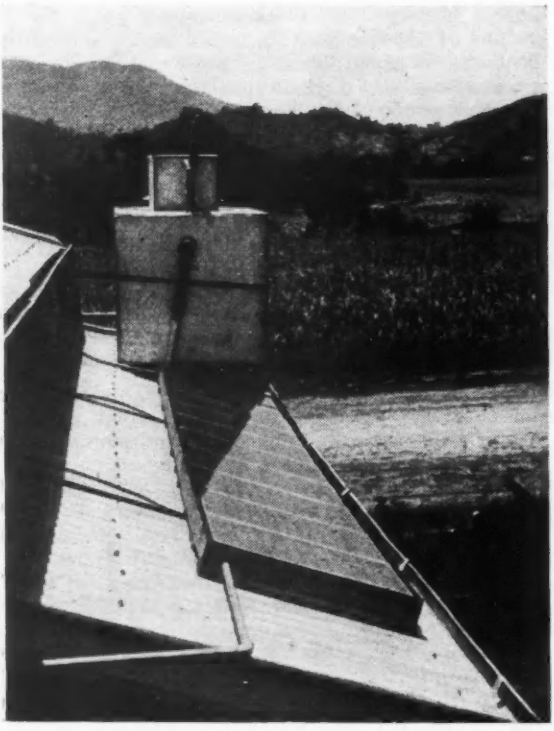

FIG. 14.—Illustrating the solar water-heating system.

Discussion.

Points Requiring Adjustment.—In an actual test, it was found that the unit was capable of heating 20 gallons of water from 95 degrees to 121 degrees on a bright, clear day in December. By some attention to the following points, it is felt that the efficiency of the unit could be greatly improved.

1. At present the tap over the kitchen sink is connected to the storage tank by 28 feet 6 inches of ordinary ½-inch uninsulated water piping. The substitution of lightly insulated ⅜-inch copper piping would eliminate much of the heat loss in transmission; moreover, in most cases it will be possible to place the storage tank much nearer the kitchen—where water is most frequently drawn. Uninsulated iron piping is also used in servicing the bathroom and wash basin.

2. Both the storage tank and the absorber rest on the roof, and, after 3 p.m., the tank, being on the western end, begins to shade the absorber. The best position for the storage tank is above the house ceiling, under cover of the roof.

3. The insulation of the absorber box is quite inadequate; the galvanised iron base rests on the galvanised iron roof, instead of being supported on an insulated floor, while, at the time of the above recorded tests, the panes of glass were laid loosely on the top of the box, instead of being sealed in. It is obvious that much valuable heat would be lost by these defects.

It has been stated earlier that the unit is operating in a manner satisfactory for our purposes, and this is no doubt due to the fact that the capacity of the storage tank is much greater than actual requirements. Nevertheless, it is obvious that with the provision of the recommended proportion of absorber surface (i.e., 1 square foot per gallon of tank storage), and the elimination of the abovementioned defects, it would be very easy to get a daily supply of 40 gallons of hot water at a temperature in excess of 150 degrees F.

Suitability for North Queensland Conditions.—We have pointed out that a minimum of six hours' sunlight per day is necessary for the efficient working of solar heaters, and thus Queensland should be almost an ideal place for their installation. Actually, some heat is absorbed even on cloudy days, but it must be expected that there will be times in the wet season when very little heating will take place. In order to investigate this point, the weather records compiled over the past four years at our Meringa Station were carefully examined. For the purposes of comparison and using 10 per cent. groupings, days with 0 to 30 per cent. of cloud were taken to be clear days; 40 to 70 per cent., to be partly clouded; and 80 to 100 per cent., clouded. On the basis of this assumption, the average number of days in each category for the four years 1937-1940 was as follows:—

Month.	Clouded.	Part Clouded.	Clear.	Average Max. Temp. °F.
January	12·5	6·5	12·0	91·7
February	11·5	6·0	10·5	90·8
March	12·0	6·0	13·0	89·1
April	9·0	7·5	13·5	86·4
May	9·5	9·5	12·0	84·0
June	10·5	7·0	12·5	81·0
July	11·5	7·5	12·0	78·4
August	8·5	4·5	18·0	81·2
September	6·0	6·0	18·0	85·0
October	7·0	7·0	17·0	88·3
November	8·5	6·5	15·0	91·2
December	3·0	7·5	20·5	92·6
Total	109·5	81·5	174·0	

From this, it is computed that on approximately 110 days per year, a solar heater in North Queensland would operate at materially reduced or low efficiency. On the other hand, with a suitably sized storage tank and adequate insulation, there is some carry-over of hot water from day

to day, so that a single day's cloudy weather would not seriously interfere with the operation of the system.

The records were then further searched to determine the number of days beyond the first, which were included in two-day or longer cloudy periods. The average number of such days was as follows:—

January	8·25
February	7·25
March	11·0
April	5·5
May	3·0
June	4·25
July	6·25
August	3·5
September	2·25
October	1·75
November	4·25
December	1·0
Total	58·25

That is to say, on the basis of low efficiency on cloudy days, and lack of carry over of hot water beyond the first cloudy day, on the average, hot water would not be available on some sixty days of the year, and on these occasions would have to be obtained from the supplementary source, whatever it might be, which had been operated in the past. On the other hand, residents of North Queensland could rely upon a free supply of hot water from a solar heater system for some 300 days of the year.

This period of constant hot water service would naturally be increased in areas west and south, where the proportion of cloudy weather is much less. Even in the north it could be further increased by the installation of a larger unit and provision for greater carry-over.

Refinements in Design of Solar Heaters.

The solar heater has been extensively developed in the United States, and particularly in California, where the ratio of cloud is low, and temperatures are mild in winter. It is used for heating water for hotels, apartment houses, industrial processes, for use in dairies, and for domestic purposes; in Hawaii, the system is widely used on the sugar cane plantations. Such installations naturally require the operation of very efficient units.

W. M. Farral, of the University of California (Bulletin No. 469, June, 1929), has carried out a thorough investigation of the principles of solar heater design and operation, and has found very considerable variation in the efficiency of different types. Contrasting black versus white absorbers, he found that, over a given period of exposure to sunlight, the standard black painted absorber raised the temperature of the water some 16 degrees F. more than did the white painted absorber.

In order to increase the heating surface of the absorber beyond that of the surface area of the actual pipes, it is usual to clamp the coil to

a metal plate (both being painted black), but better contact (and hence better heat conduction) between the pipes and the remainder of the absorbent surfaces is obtained by the affixing of metal fins to the pipes. A less expensive but efficient practice is to embed the coil partially in a thin layer of concrete, which forms a very efficient absorbing and conducting medium.

The value of the greater heating surface, such as is obtained by embedding the coil in a concrete bed, and of the use of glass to reduce the cooling effects, is demonstrated by data submitted by Farral, as under:—

Type of Absorber.	Temperature Increase in Water, °F.
Simple absorber, uncovered	9·6
Simple absorber, glass covered	15·7
Coil embedded in concrete, uncovered	15·5
Coil embedded in concrete, glass covered	19·0

By the use of a double layer of glass, re-radiation of absorbed heat may be reduced to a minimum and the heating capacity of the heater correspondingly increased; insulation of the absorber is also of great importance in the achievement of best results. Farral, working with an absorber insulated with 3 inches of cork board, has obtained air temperatures as high as 230 degrees F. beneath a single layer of glass, and 280 degrees F. beneath a double layer of glass.

Conclusion.

The solar heater method of heating large quantities of water is obviously well adapted for exploitation under the bright sunshine characteristic of Australia, and particularly of Queensland. It is, therefore, astonishing to find that the principle has never been adopted here. Enough has been said to demonstrate that the monetary outlay required for the installation of a domestic solar heating system is within the means of every householder; that the unit may be built by any enthusiastic amateur; and that a satisfactory hot water supply is assured even in the most cloudy part of the State. In a properly constructed unit the first outlay is the only outlay, and thereafter, year after year, the supply of hot water is available—convenient, abundant, continuous, and *free*.

A Correction.

In the issue of April, 1941, was presented an article on "Rubber Belting on the Farm." We would direct attention to an unfortunate typographical error occurring in the first line of the second paragraph of p. 138: the word "caused" should be "cured," so that the sentence reads—"Persistent slip on the pulley may be cured by bolting or riveting a piece of rubber belting on the face of the pulley."

One Year After the 1940 Burdekin Flood.

BY H. W. KERR.

EARLY in April, 1940, the Lower Burdekin district experienced the most disastrous flood in its history. A full account and illustrations of the damage which it caused were presented in the Quarterly Bulletin for July, 1940. Since that time, the writer has visited the district on several occasions, and it may be of interest to record what has been done, both by the farmers and the Government, to repair the damage and guard against a recurrence.

Soil tests made immediately following the flood showed that the subsoil of these river lands, as well as the sands washed from the eroded soils and deposited as the velocity of the flood waters was checked, exhibit a degree of fertility not usually met with under these conditions; and it was forecast that the damaged lands, as well as the fine sand deposits, would be capable of producing crops at no distant date, if the inevitable nitrogen deficiency were made good. That this has been possible is amply demonstrated by the excellent crops of mature cane now to be seen on many such fields. The speed with which the job was tackled and the trouble put right is a high tribute to the courage and determination of the farmers who were so badly hit by the flood.

FIG. 15.—Illustrating the extent and nature of the sanding which certain fields experienced. What remained of the mature crop had been harvested when the photograph was taken.

A further interesting set of pictures has been obtained in the course of farm visits and some of these are published at this time. We reproduce, first of all, a view of a badly-sanded field of plant cane (Fig. 15), which was printed in the October Bulletin last year. When

the same field was inspected later in the year, it was found that the farmer had graded and ratooned the block: the ratoon shoots originated, of course, from the eyes of the buried plant crop sticks, and these had been present in great profusion. However, the farmer destroyed such of these as were not wanted, by the use of implements, to enable him to irrigate the crop if necessary. The block then appeared as shown in Fig. 16, and at the present time, this is an excellent crop of mature Badila. Doubtless, the field will be ratooned once more, and continued under such crops as long as possible; this will give the sand a chance to mellow into fertile surface soil before it has again to be planted. The existence of the buried surface soil has certainly contributed much to the nutrition of the present crop.

FIG. 16.—Illustrating the field shown opposite (Fig. 15) after the ratoons were well advanced.

The Badila ratoons illustrated in Fig. 17 were produced under similar conditions, and are estimated to yield at least 35 tons per acre.

It will be recalled that the Government took early action with a view to repairing the breaks in the river bank, and granted a substantial sum of money to cover the cost of the work. The engineer (Mr. Fison) who was delegated by the Co-ordinator General of Public Works to control the job decided that the repair work might be carried out according to two alternative plans—(1) the construction of earth levees, provided a supply of suitable filling were handy to the job, or (2) the erection of permeable bulkheads (Fig. 18). The former type of construction would be the cheaper, but it presented a measure of risk should further damaging floods supervene before the earth works were thoroughly consolidated and protected. The majority of the jobs were therefore of the bulkhead type, but a few earth levees were successfully installed. Fortunately, the 1941 wet season was free from heavy floods, while it was generally favourable for the establishment of protective vegetation on the bared banks.

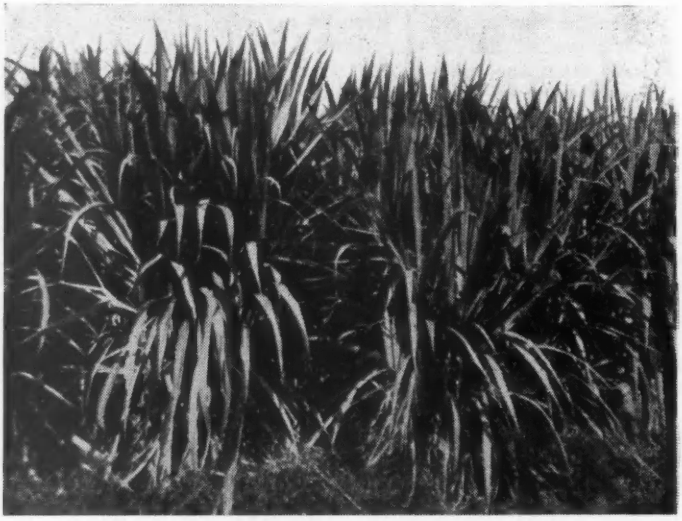

FIG. 17.—An excellent crop of Badila ratoons produced on a heavily sanded field.

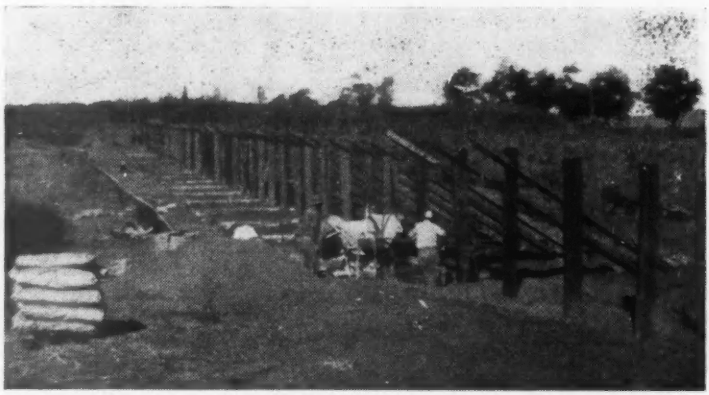

FIG. 18.—Illustrating the details of the protecting bulkhead: note concrete apron in course of construction.

The illustrations presented provide some conception of the construction of the bulkheads: the purpose of these is to obstruct and restrict the flow of flood waters at the low points adjacent to the river banks, thus effecting a greatly reduced water flow, and inducing silting of the gullies. These are built of piles and sheeting timbers, and are intended primarily as a safeguard in times of future high floods, until a thicket of protecting shrubs and trees can become established both in front of and behind the bulkhead, to provide a heavy vegetative cover. Wherever such a flora existed during the 1940 flood, no damage was caused by the waters pouring over the banks or through existing gullies.

The species of shrub most highly favoured is the Duranta, a well-known hedge plant which thrives in coastal Queensland. The accompanying illustration (Fig. 20) shows how well it grows under the dry Burdekin conditions. This is portion of a farm hedge, and had attained a height of about 15 feet. Its virtue in times of flood lies in its thicket growth and especially in the retention of a mass of lower branches and leaves which extend practically to the ground.

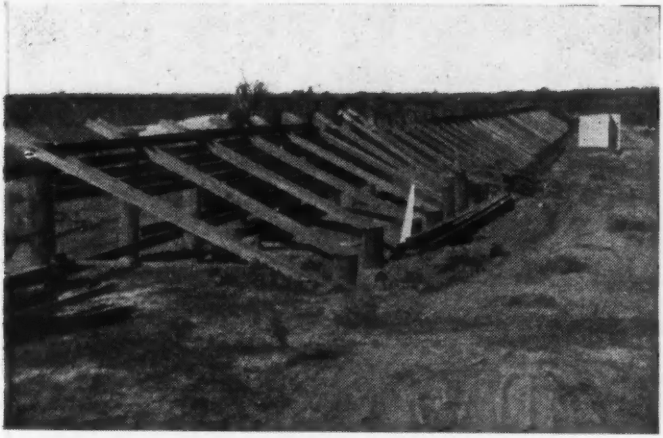

FIG. 19.—Front view of partially constructed bulkhead.

FIG. 20.—Showing an old Duranta hedge on a Burdekin farm.

Several thousand cuttings of this species were grown by the Forestry Department, and at the Mackay and Meringa Sugar Experiment Stations, to be transported to the Burdekin and planted several

rows wide along unprotected portions of the banks. Fortunately the rainfall conditions were generally favourable following planting, and the majority of the shrubs should become established.

FIG. 21.—Illustrating the high-power tractor and bull-dozer attachment.

FIG 22.—Tractor and scoop at work in the construction of an earth levee.

Of special interest was the heavy tractor equipment made available for the construction of the earth levees. The 85 H.P. Diesel tractor (Fig. 21) was provided both with bull-dozer, and hydraulically-operated scoop, which had a capacity of 8 cubic yards. It is shown (Fig. 22) putting the finishing touches to the first earth levee which was formed on the Home Hill bank. As soon as this job was completed, the farmer set to work planting all types of grasses or other vegetation which could be expected to grow—anything, in short, which would provide cover and binding power through its root system—in advance of the 1941 wet

season. This was successfully accomplished by the aid of irrigation, and in the course of a year or two the more permanent vegetation which has been planted should assure the security of the work.

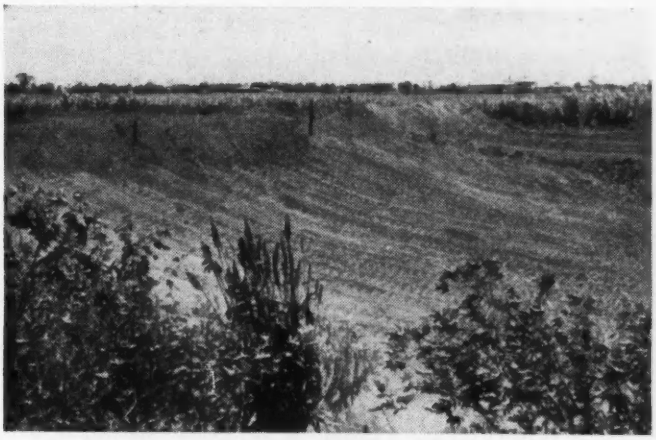

FIG. 23.—The earth levee (Fig. 22) practically completed, Home Hill farm.

Farmers' Cane Samples for C.C.S. Tests.

Each of the sugar experiment stations offers to cane growers in the districts which it serves, a free cane testing service to guide him in selecting his most mature field for harvesting. But certain requirements have been stipulated, and these must be carefully observed if farmers wish to avoid disappointment. These are:—

(1) The sample *must* consist of at least six stalks.
(2) *Burnt* samples *will not be tested* in any circumstances.
(3) Samples sent by rail must be prepaid. If the forwarding railway station is not open for payment of freight, the amount of 1s. per bundle is to be forwarded to the experiment station with the covering letter. By special arrangement with the Railway Department a flat rate of 1s. per bundle covers the freight on these samples.

The c.c.s. test obtained at the experiment station small mill is not intended to be a check on the mill tests and is useless for that purpose. Owing to the number of samples being delivered to the experiment station during the currency of a harvesting season it is not possible to carry out separate tests on tops, middles, and butts as is frequently requested.

The small mill test has a definite value in assessing relative maturity of a number of blocks of cane, providing the sample is collected with care. Six stalks from a few square yards of a 10-acre field is quite valueless, since the sugar content of the block may—and probably does—vary from one part of the field to another. The sample should be taken diagonally across a block—with due regard to the percentage of short and tall stalks. Suckers should not be included unless they constitute a high proportion of the millable sticks present in the block.

H.W.K.

Q.25 in Southern Queensland.

The accompanying photograph (Fig. 24) indicates the nature of the growth of variety Q.25 under rather favourable conditions in Southern Queensland.

FIG. 24.—Illustrating growth of Q.25, with field of Co.290 in background, at Childers.

Our field officer (Mr. C. G. Story) is holding a stick of Q.25, twelve months old, grown on a moist farm in the Isis district. The cane in the background is Co.290, of the same age. The crop of Q.25 from which the stick was cut actually yielded over 41 tons per acre, at 15·2 c.c.s.

H.W.K.

New Green Manure Crops.

BY N. J. KING.

AMONG the various activities of the Bureau of Sugar Experiment Stations is the testing of green manure crops from abroad or produced in Australia. From time to time this Bulletin has contained articles dealing with the Gambia pea (*Crotolaria goreensis*) and the New Zealand blue lupin, and as a result of our experiments and writings on these two crops both have attained some degree of interest on the part of cane growers.

Many new species of green manure crops are tried on the Experiment Stations, are found wanting in some desirable feature—such as good early cover, quick germination, vigour, and resistance to bean-fly attack—and are discarded; these the cane grower hears nothing about. The work goes on, however, and when a promising species is found, due publicity is given to the fact and seed is collected to form a nucleus of commercial supplies should the demand warrant it.

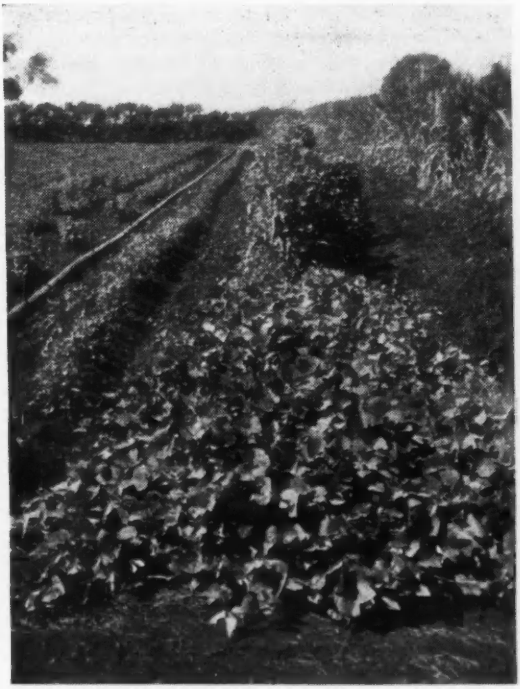

FIG. 25.—Showing the growth made by three "Giru" bean vines, Bundaberg Station.

At the present time two promising species are under preliminary trial at the Bundaberg Sugar Experiment Station. During 1940 the Director (Dr. H. W. Kerr) noticed some plants of a green manure type growing wild in the Giru area. The plants appeared vigorous, though not receiving any attention, and it was thought that any crop of such a nature which would grow without care in an area of such low rainfall may have valuable drought-resisting qualities. Dr. Kerr collected a few mature seeds and these were planted on the Experiment Stations. In Bundaberg only three seeds germinated, and these have grown vigorously; by mid-May they covered an area 20 feet by 12 feet. The conditions were fairly good, and it is possible that Poona pea would have developed just as well. However, the crop appears to have at least one valuable feature not possessed by the Poona pea—and that is a prolonged growing period. The seeds were planted in mid-November and only began to flower in early May. The rapid maturing of the

Poona pea is in many ways undesirable. It generally forms mature pods in February—in the middle of the wet season—when it is not practicable to plough it in. The result is a thick, volunteer crop necessitating further cultivation to kill it; if planting of cane follows rapidly on the ploughing-in of the Poona pea the volunteer crop may be costly to eradicate from the young cane. Cane growers, particularly in the wet areas, require a crop which would not seed so early in the wet season—in other words, a crop with a long growing period. If this newly discovered species lives up to its present promise it may be a valuable variety in such wet areas. Tentatively the crop has been named the "Giru bean" until such time as it can be identified by the Government Botanist.

FIG. 26.—Illustrating the growth of *Dolichos biflorus*, with sorghum nurse crop.

The other variety under trial was imported from South Africa. It is named *Dolichos biflorus*. Mr. F. Manson Bailey, one time Government Botanist for Queensland, lists this species as being a native plant in far North Queensland, where it was called "Mal-kan" and "Tandaji" by the aborgines. It is also known as "Horse Gram" in India. This variety is a fine-stemmed creeping plant and it is recommended by South African authorities that it be grown with a nurse crop; this is some tall growing plant, such as sorghum, on which the Dolichos can climb. This species flowered about a week earlier than the Giru bean and is setting a good crop of seed. It is yet too early to state whether this crop has any definite value, but in areas where moisture is plentiful and there is no restriction on maize growing a planting of alternate rows of each may serve a dual purpose—the maize crop could be grown for grain and a green manure crop obtained from the Dolichos at the same time.

The two photographs illustrate the type of crop obtained from the Giru bean and the *Dolichos biflorus*. The latter was planted with a grain sorghum so that it would have a nurse crop on which to climb.

How to Obtain Better Cane Strikes.

BY N. J. KING.

IN a recent number of the "Cane Growers' Quarterly Bulletin" (October, 1940, p. 63) Dr. H. W. Kerr drew attention to the results of a comprehensive experiment carried out in Hawaii on the germination of cane setts. One of the major points of interest arising from the investigation was the fact that setts cut from the upper one-third of the stick gave the quickest and best germination—those from the middles and butts being definitely inferior, both in speed and completeness of germination. *And these results were obtained on cane which was only ten month old when cut for plants.* It was pointed out that, the older the eye, the greater its chance of having been injured either by insects or mechanically during its lifetime.

In South Queensland our planting season may be divided roughly into spring and early autumn. In spring, farmers generally endeavour to obtain plant cane about twelve months old—although many growers prefer ratoon cane of the same age. In autumn (February-March) they prefer to plant spring plant cane which would be about sixteen to seventeen months old at this time. As the spring is normally a dry period, it is not uncommon to find a shortage of good quality plants in the February-March season, and this shortage is accentuated by the obligations of disease control measures.

It is therefore seen that we are using plants from cane which is from twelve to seventeen months of age. If the Hawaiian experience can be applied validly to Queensland conditions and varieties, then we would expect the poor germination of plants from the lower half of the stick to be worse here, since our cane is older than their ten months crop. It was decided to make an experimental planting along these lines.

A block of spring plant cane was selected as a source of plants. It was on rich river alluvial land and the crop was in good condition. At time of planting—February, 1941—the crop was seventeen months old. The variety was P.O.J.2878.

Plants were cut on this river farm, carted to the Sugar Experiment Station, soaked overnight in water, and planted the next day. For one portion of the block, plants were cut from the entire stick; on the other portion of the block we used plants from the top half of the stick only. The bottom half of these sticks was weighed so that their value could be calculated, and they were then planted on a non-experimental area alongside the other plantings. All plants were treated similarly with regard to soaking, fertilizing, &c. Planting was carried out from 12th to 14th February. On 10th February 135 points of rain had fallen, and this put the soil in excellent, moist condition; for six weeks after planting sufficient rain fell to prevent any drying out of the soil at the depth of the cane setts. Soil moisture was therefore not a limiting factor in cane germination. Five weeks after planting the strike appeared to be as complete as it was going to be, and after digging up many setts and finding the eyes dead it was decided to supply the block.

Careful counts were made of the number of supplies planted in each area, and the following results were obtained:—

Plantings from top half of stick only, gave—93 per cent. strike.

Plantings from whole stick, gave—62 per cent. strike.

Plantings from bottom half of stick, gave—25 to 30 per cent. strike.

The photographs illustrate what the various sections of the field looked like.

FIG. 27.—Showing the type of strike obtained when plants from the full stick were used.

In supplying, the same procedure was followed—only the top half of the stalk was used to supply that section of the field planted with top-half setts, and the full stick on the other section. The discarded butts were again weighed. The differences as shown above were so great that it was decided to analyse the costs of the two plantings—top half versus whole stick.

Treatment A. Top half of stick only.	s.	d.	Treatment B. Whole stick.	s.	d.
Cane planted originally 9.4 cwt. at 35s. per ton	16	5	Cane planted originally 12 cwt. at 35s. per ton	21	0
Supplies 2 qr. 9 lb.	1	0	Supplies 5 cwt. 2 qr. 14 lb. ..	9	10
Labour cutting supplies	0	10	Labour cutting supplies	3	10
Labour planting supplies ..	2	5	Labour planting supplies ..	13	10
Butt half rejected when planting 14.6 cwt.	25	7			
Supply butts rejected 3 qr. 18 lb.	1	7			
Total	£2	7 10	Total	£2	8 6

(Labour costs are calculated on the field workers' award wage.)

It is apparent from these figures that it cost approximately the same to plant only the top half of the stalk. This was because of the much lighter supplying required. If the planting had been done in

spring, the butt half of the stalk would have gone to the mill and the figures would be in favour of using the top half only for plants. The above figures are on an area of two-fifths of an acre of each planting. Reduced to an acreage basis the costs are:—

Using top half only—£5 18s. 1d. per acre.

Using whole stick—£5 19s. 9d. per acre.

However, the above is not the whole story. It is generally known that supplies do not make as good stools in the crop as do the originally planted setts. It follows, therefore, that the "whole-stick" planting is not going to establish such a good stand of cane as will the top half planting. It is to be expected that we will obtain a higher tonnage per acre from the "top-half stick" planting; or, in other words—greater financial return for the same outlay.

FIG. 28.—Showing the excellent results from "top" setts only.

It is not claimed that results such as the above will always be obtained. This is a single experiment, and hard and fast conclusions cannot be drawn from it. Much more work is required to thoroughly confirm its actual value. We have not a very clear understanding of all the factors governing germination of cane, but most farmers know from past experience that the butt plants on the stick are generally poor strikers. Supplying of cane fields is a costly matter—more costly than is generally appreciated. The longer jointed P.O.J. canes do not give so many eyes per acre as did the old Q.813 and D.1135 even though we utilize the same number of setts per acre. Two ways of overcoming this suggest themselves; (1) double planting (i.e., laying two setts side by side) to obtain more eyes per acre, and (2) using only the better eyes in the stick (i.e., the top half of the stalk). The former method was also tried on the Experiment Station some years ago (*see* "Cane Growers' Quarterly Bulletin," October, 1937, p. 42), and an increase of 2·3 tons per acre was obtained over the ordinary single planting. There was also much less supplying to do in the double planted area.

Many a good stand of cane is spoilt by a poor initial germination, and South Queensland growers could with advantage take a hint from the Hawaiian plantations where planting is carried out almost invariably with the top portion of the stalk only. In fact, "top planting" is characteristic of nearly all sugar-cane countries, and apparently the advantages of the method are recognised in those places. If planting is to be done in Queensland in the harvesting season the top half of the stalk would be cut off for plants and the bottom half sent to the mill. This would mean an additional saving in that the lower c.c.s. cane is used for plants. If planting is not done in the crushing season, then the bottom half of the stick would be thrown away—and the above figures suggest that the better germination obtained would pay for this wastage by not requiring the expenditure on supplying the field.

FIG. 29.—Showing the poor strike resulting from the use of discarded "butt" setts.

It is sometimes argued that, although supplies may not make much cane in the plant crop, they make normal stools in ratoons. There is good reason to believe that this is not correct. Officers of the Experiment Station staff have investigated this phase of cane growth in the past. They have gone through fields of cane of different varieties, counted the stalks in a large number of good stools and poor stools prior to harvesting; then they have counted the stalks in these same stools in the subsequent ratoons. It has been established that a poor stool in the plant crop remains a poor stool in the ratoon crop, and it can be accepted that the "supply" stool does not usually become a normal stool even in the ratoon crops.

It was noted in the experimental planting of the "whole-stalk" plants and the "top-half stalk" plants that the latter were more rapid in germination and established an early lead in growth. This quicker germination of the top setts also decreases the chances of development of pineapple disease and other sett-rot ailments. The development of pineapple disease, the cause of many strike failures in the Burdekin area, is greatly accentuated by slow germination. It would follow,

therefore, that the occurrence of this disease would be appreciably reduced by the use of rapid-striking top plants only.

In the same district, as well as in other parts of North Queensland, much bud damage is occasioned to standing sugar cane by various insects. Such buds, when planted, would obviously fail to germinate. The older buds—that is on the lower part of the stalk—are naturally most affected by the insect damage, and again it becomes evident that the use of top plants only would be advantageous. The top buds are better protected against such damage.

It is hoped to obtain more information on this important subject. Plans are being made for more experimental plantings in the coming spring, utilizing cane of various ages and also experiments with soaking plants in solutions of various substances as well as in water. Reports from other sugar-cane countries have, at times, claimed improved germinations from soaking setts in weak solutions of lime, calcium nitrate, &c., and it will be in the interests of the local industry to investigate the possibilities of any such treatment in Queensland.

Cane Disease Control Boards.

School of Instruction for Inspectors.

BY ARTHUR F. BELL.

AMONGST other things, the 1938 amendment of the Sugar Experiment Stations Act provided for the constitution of Cane Disease Control Boards, charged with the responsibility of implementing suitable measures for the control of such sugar-cane diseases as might be prevalent in their particular district. Eight Disease Control Boards have since been constituted and have now been functioning for a sufficient period to enable the value of the innovation to be assessed. We believe that we can now state without reserve that the scheme has been eminently justified by results, and that it fulfils a long-felt want.

Naturally, the elected representatives comprising the Boards, and their employees, had in most instances to "start from scratch" and acquire knowledge and experience as they went along, but progress has nevertheless been gratifying and operations are proceeding on an increasingly firmer basis. At the outset, it was necessary to concentrate on the one or two most serious diseases of the district and little attention could be paid to the wider training of employees. As time went on, however, it became apparent to all that Boards could not function with maximum efficiency unless their employees had a better understanding of the principles underlying the methods of disease control they were putting into operation and—most important—unless they were in a position to recognise diseases not now present in their district, but which might be introduced there at any time.

The most useful equipment in the war on plant diseases is to be able to recognise a new outbreak of disease in its very early stages, so that it can be dealt with promptly. For example, Fiji disease has not yet spread to Central and North Queensland, although there is every reason to believe that it could cause havoc among the susceptible varieties of those areas (Mackay grows 90 per cent. of Fiji susceptible varieties). If the disease were introduced by some illegal transfer of cane, it would very obviously be greatly to the advantage of the

Northern or Central growers if the outbreak could be detected while it was still confined to a few plants. At the same time, such early detection is only possible if the Disease Control Board Inspectors are familiar with the disease and capable of recognising it on sight.

These considerations prompted the planning of a school of instruction in cane disease control, and all Boards were invited to send representatives to a school held at the Bundaberg Sugar Experiment Station from 12th–16th May. The response of Boards was highly gratifying and available accommodation was taxed to provide for the tuition of the fifteen representatives of seven Boards enumerated hereunder:—

Board.	Inspectors.
Mossman	A. R. Taylor
Mulgrave	P. Volp
Mackay	W. R. Vacher, L. Donohoe, H. W. Hack, V. J. Kane, and B. Templeton
Bundaberg ..	J. Bourke, N. Courtice, and D. James
Isis	E. Luckett
Maryborough ..	C. A. Petersen, A. W. Mathies, and F. Stalley
Moreton	M. H. Wells

The routine of the school consisted of lectures extending over about four hours per day, the remainder of the time being spent in observing laboratory demonstrations of points raised in the lectures. The course included a study of the normal healthy plant and the manner in which its normal functions were disrupted by disease; discussion of the general principles of methods available for disease control; comprehensive individual study of the more important sugar cane diseases; and close examination of the symptoms of diseases for which Inspectors should be on the lookout.

Advantage was taken of the disease resistance trials being conducted in Bundaberg, in order to demonstrate certain disease symptoms, while fresh specimens of other diseases were collected from various sources and forwarded to Bundaberg day by day. All the officers attending the school should now be in a position to recognise any cane disease of importance which might unfortunately be introduced into their particular areas.

The keenness evinced by the Inspectors was very gratifying and encouraging to the Bureau staff who conducted the school and augers well for the continued and increased success of Disease Control Board operations.

Dangers of Too-Deep Ploughing.

There is plenty of evidence to show that many growers, particularly those farming the acid-alluvial soils, are ploughing too deeply when preparing the land for planting, in the Innisfail-Tully district.

In most fallow fields an abundance of raw sub-soil is apparent on the surface, and mixed with the fertile surface soil. Where this has occurred, decreased crop yields will necessarily follow and corrective measures will be slow and costly.

While it is desirable to have a deep, fertile soil the process of deepening should be done gradually, and not more than ½ inch to 1 inch of the sub-soil ploughed up during each crop rotation. More attention should be paid to depth of furrow when ploughing, and if much sub-soil is being disturbed the plough should be lifted until a minimum is being brought up.

It might be argued, in some cases, that unless the plough is kept at a depth at which much sub-soil is brought up it is not possible to obtain a deep, friable seed-bed in which to plant the sett. In these circumstances it would be much better to keep the plough at a safe depth and create a deep, friable seed-bed by grubbing deeply prior to planting, or sub-soiling when ploughing, and in this manner improve the depth of tillable soil.

H.G.K.

Forthcoming Plantings of Q.25.

A Warning Regarding Mosaic Disease.

The new seedling variety, Q.25, has performed so well in South Queensland during the past two years that a large number of growers have, no doubt, decided to make spring plantings this year. Two years of field experience with this variety have given us much valuable information on its suitability for a variety of soils and conditions, and those growers intending to plant it would be well advised to take note of the following facts:—

(1) The variety is resistant to downy mildew disease. Some 600 to 700 acres of Q.25 were planted in the Bundaberg area last spring—the majority of it in the downy mildew affected districts. During the year only *two* stools of downy mildew have been found in this variety.

(2) Q.25 is definitely susceptible to Fiji disease and its planting cannot be recommended on farms or in districts where an appreciable amount of this disease exists.

(3) As reported in the "Quarterly Bulletin" for April (page 127), the variety contracts mosaic disease freely where there is mosaic in close proximity to it. During the present year strong efforts have been made to eradicate all mosaic from plantings of the variety, by constant inspections and diggings, so that a clean source of plants will be available this coming spring. During these inspections it has been very evident that mosaic becomes a menace to the variety under certain conditions. These are:

(*a*) On river farms where grass and weed growth is bad.
(*b*) On farms of other soil types where Johnson grass is a pest.
(*c*) On farms where maize and sorghum are grown.
(*d*) On all farms where the Q.25 is planted alongside such mosaic susceptible varieties as P.O.J.213 and Mahona.

On all clean farms, where grass growth is kept down and maize and sorghum are not grown, and where the Q.25 is planted between blocks of varieties which are resistant to mosaic (e.g., P.O.J.2878 and Co.290) Q.25 has remained reasonably free of this disease.

The advice offered to growers is, therefore:—

Plant only healthy planting material as recommended by the local Cane Disease Control Board.

Do not plant Q.25 in blocks which are difficult to keep free of grass and weed growth; and do not plant it adjoining blocks of P.O.J.213 and Mahona. Planting Q.25 on river flat lands is only storing up trouble for the future.

Do not grow maize or sorghum near plantings of Q.25.

Autumn planting of the variety will render it less likely to contract mosaic than if planted in spring. Mosaic is spread by the corn aphis, and this insect is much more plentiful in the summer months than at other times of the year. Spring plant cane is small in the summer months and is in an ideal state to become infected. On the other hand, autumn plant cane is well advanced by the following summer and, by reason of its age, is less susceptible to attack. It is a well established fact that the older the cane the less susceptible is it to mosaic disease.

N.J.K.

Preservation of Portable Rails.

Owners of portable rails are often perturbed by the amount of rusting that takes place during the slack season. With some rails, this results in deep pitting and flaking, and the ruin of the rail after a comparatively short life. Tarring is the usual preventive, but is costly, and not particularly effective when rails have become rusted. Oil will penetrate rust, and prevent further rusting while the oil remains there.

With this idea in mind, we tried the effect of spraying our rails with used tractor sump oil. We consider the results satisfactory. Our rails have now been sprayed with oil for three or four successive years, and during that time there has been no rusting. At the conclusion of harvesting, the rails are stacked on logs, to keep them from the ground, and sprayed with oil with the aid of a knapsack sprayer. The oil sprays best if warmed or diluted with kerosene, and a fine hot day is best for the job. It is not necessary for the entire surface of the rails to be sprayed, as the oil "creeps" considerably. Roofing the stacks prevents heavy rain from beating the oil from the more exposed rails. If no roofing material is available, it may be necessary to give a second spraying toward the close of the wet season.

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